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NOTE ON BALANUS HAMERI IN THE PLEISTOCENE AT RIVIÈRE BEAUDETTE, AND ON THE OCCURRENCE OF PECULIAR VARIETIES OF MYA ARENARIA AND M. TRUNCATA IN THE MODERN SEA AND IN THE PLEISTOCENE.

BY SIR WILLIAM DAWSON, LL.D., F.R.S.

(1.) *Balanus Hamon.*

The fine species of Balanus above named, which is still living in somewhat deep water on our coasts, was first described as a Pleistocene fossil of Canada by Sir C. Lyell in his paper on "Fossils and Recent Shells collected by Capt. Bayfield."[1] Bayfield found it in the Pleistocene at Beauport, near Quebec. It was subsequently found by me in the Pleistocene at Rivière du Loup, St. Nicholas, and Montreal.[2] From the loose attachment of its radial plates, it is

[1] Philos. Trans. 1859.

[2] "Notes on Post Pliocene of Canada." Canad. Nat. 1872.

usually found in fragments, but entire specimens occur attached to stones and boulders at R. du Loup.

B. Hameri is at present extensively distributed as a living species in the North Atlantic and the Arctic Sea. I have specimens collected by Mr. A. Downes of Halifax, Nova Scotia, in a living state, near Halifax harbour. As a Pleistocene fossil, it occurs at Uddevalla in Sweden, and was named by Linnaeus *Balanus Uddevalensis*. The name *B. Hameri*, given by Ascanius in 1767, is that now recognized. It has also been found in Pleistocene clays in Greenland (Spengler), and in the Pleistocene of Russia (Murchison).

The specimens now under consideration are interesting, as being found farther west than previously; River Beaudette being on the line of the Grand Trunk Railway, 34 miles west of Montreal, and the locality being near its entrance into Lake St. Francis. They are also interesting from their remarkable perfection and the large masses which they form, some of which contain as many as a dozen individuals attached to each other. The specimens were collected by Mr. A. W. McNown, of Rivière Beaudette, and by Mr. Stanton, C.E., of Lancaster, and much credit is due to these gentlemen for their care in collecting and preserving these interesting fossils.

The animals seem to have been covered, when living, with an irruption of sand, for the opercular valves of many of them are still in place, and owing to a slight infiltration of calcareous matter, the radial plates and opercular valves have been cemented together, which accounts for their perfect preservation. It is to be observed, however, that the sheils of Balani are composed of a remarkably dense and indestructible calcium carbonate, much less perishable than the shells of most mollusks.

The original attachments of the animals, so far as observed, have been on pebbles on the surface of clay, and as these afforded space only for one or two individuals, the young were obliged to attach themselves to the old in successive generations, forming most grotesque groups, which still remain entire.

In the same deposits were found shells of *Saxicava Arctica*. *Tellina* (*Macoma*) *Groenlandica* and *Mya arenaria* of a small variety. These shells would indicate cold and not very deep water; and although *B. Hameri* is at present a deep-water species, it is probable that in cold water it lives, like some other species, nearer the surface than in the warmer seas.

The specimens were found in an excavation near the railway, and so far as appears from the descriptions, in beds which belong to the top of the Leda clay and base of the Saxicava sand, a position which is usually the most productive part of our Pleistocene deposits in fossil shells.

From a note and sketch kindly furnished to me by Mr. Stanton, it appears that the shells occur about 27 feet below the surface, and about 11 feet above the level of Lake St. Francis. The containing beds are clay and sand, and above these are alternations of clay, sand and gravel, the top being gravel, with boulders immediately under the surface soil. The position of the shells would thus appear to be in what I have called the Upper Leda clay, or the base of the Saxicava sand, and under the newer gravel and boulder deposit which often caps the latter.

(2.) *Species of Mya, and Varietal Forms.*

In my Notes on the Post Pliocene of Canada,[1] I have remarked on the small size, peculiar forms and comparative rarity of *Mya arenaria* in the Pleistocene, as compared with the modern Gulf and River St. Lawrence, and on the abundance of *Mya truncata*, and especially of the short variety (*M. Uddevalensie*), while *Mya truncata* is comparatively rare in the modern waters of our coast, and the short variety especially so. I had last summer an opportunity at Little Metis to see both species and their different varieties living together in such a manner as to illustrate better the causes of the difference of the Pleistocene forms.

At the head of Little Metis Bay, where the water is shal-

[1] Canadian Naturalist, 1872.

low and warm, and the bottom is soft mud and sand, a large variety of *Mya arenaria* is very plentiful in the flats bare at low tide; so much so that the place is resorted to by fishermen from localities lower on the coast for bait. It sometimes attains the length of 4½ inches, and has a thick, dense shell, without perceptible epidermis, and often with radiating bands. So far as I am aware, neither *Mya truncata* nor the peculiar variety of *M. arenaria* referred to below, occurs on this part of the coast.

I have not infrequently dredged *Mya truncata*, usually the long variety, but sometimes the short Uddevalensis variety, in deep water outside the bay, but have not seen it above low-water mark, though it occurs not far from this line; and, on the opposite side of the River St. Lawrence, I have found it at Tadoussac, where the water is still colder, close to low-water mark. I was not aware that *Mya arenaria* occurred on the comparatively steep and stony shore outside the bay, and it is certainly not found there inside of the low-water limit.

Last summer, however, after a heavy easterly gale, great numbers of *Mya arenaria*, in a living state, and a few specimens of *M. truncata*, were thrown up on the beach, and must have been derived from the mud disturbed by the breakers at no great distance outside of low-water mark, or on a slight bank a little further seaward. These shells were all of small or moderate size, somewhat round and flat in form, much wrinkled and covered with a thick brown epidermis which extended a little way beyond the posterior end of the shell, which was, however, rounded and not truncated, and destitute of the corneous tube of *M. truncata*. Still, many of the specimens might, at first sight have been mistaken for *M. truncata*, with the tube partly broken off. This enabled me, for the first time, to understand the remark of Fabricius, that in Greenland the two species are so similar, that but for the hinge and the tube they might be confounded. With these were thrown up specimens of *M. truncata*, which must have lived with the others, the inner limit of *M. truncata* probably overlap-

ping the outer limit of *M. arenaria.* The short or Uddevalensis variety of truncata was, however, very rare, only a few shells in a perfectly recent state having been found, and they probably lived in somewhat deeper and colder water than the others. The water, I may add, on this coast is so far affected by the Arctic current as to be quite cold, except near the shore and in shallow bays, and the species dredged in 10 to 15 fathoms are, in general, similar to those of the Labrador coast, belonging rather to the boreal than to the Acadian fauna. With the Myas were cast up shells of *Solen ensis*, var. *Americanus* of Carpenter, and of *Machaera Costata*, the latter sometimes of large size, though it is more abundant in the warmer water at the head of the bay, where *Purpura Lapillus*, a rare shell on this coast, also occurs on the reefs.

It is evident that though there is no passage from one species into the other, the long variety of *Mya truncata* represents the extreme limit of modification of that species for a shallow and warm-water habitat, while the small epidermis-clad variety of *M. arenaria* represents its extreme modification for deeper and colder water than usual; and along the coast at Metis these two varieties meet.

The coldness of the Pleistocene seas thus explains the occurrence, in the Upper Leda clay, of the peculiar small and epidermis-clad variety of *M. arenario* and of the short form of *Mya truncata.* The conditions in the colder parts of the River St. Lawrence approach in these respects to those of the Pleistocene, though they are no doubt more fully realized in the Arctic seas.

As I have remarked in my notes on the Post Pliocene, the brown wrinkled epidermis-clad variety of *M. arenaria* occurs plentifully along with *M. Uddevalensis* in the Upper Leda clay at Rivière du Loup.

From the accounts of Arctic collectors from Fabricius downwards, it would appear that in Greenland, as in Pleistocene Canada, *M. truncata* is very abundant, and occurs at low water in the sands, as *M. arenaria* does further south. It would seem also that it forms a large part of the food of

the walrus and other animals, and is much used by the inhabitants. It also appears that a small variety of *M. arenaria*, with brown epidermis, is most common in Greenland and occurs with *Mya truncata*, which is, however, more plentiful. The description given by Fabricius of *M. arenaria* obviously agrees with that of my small and brown variety from Metis.

It is interesting to note the companionship of these allied species in the North Atlantic throughout the Pleistocene and Modern periods, and their range of varietal forms applicable to each, according to the conditions to which they they have been exposed, along with their continued specific distinctness, and the preference of each for certain kinds of environment, so that in some places one, and in others the other, predominates, while this relative predominance, as well as the prevalence of certain varietal forms, might no doubt be reversed by change of climate or of depth.